

ANALYSIS AVAILABILITY OF HOTS INDICATORS ON SENIOR HIGH SCHOOLS PHYSICS EXAM QUESTIONS IN AGAM DISTRICT

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ABSTRACT

Efforts to improve the quality of education in Indonesia continue to be carried out by the Government. One of the ongoing agenda is curriculum development. The 2013 curriculum requires students to have thinking skills, one of which is Higher Order Thinking Skills (HOTS). To achieve this, teachers must practice using strategies to train students to think higher order. It is time to implement HOTS questions in learning. HOTS-based questions can make students skilled in the ability to solve problems, skilled in decision making. The results of the observations show that the questions used in Senior High School throughout Agam Regency are still in the low category and do not meet the good proportion of questions. Therefore, research on the analysis of the HOTS indicator was carried out on physics questions at Senior High School Agam in Agam. This research is descriptive research with a qualitative approach. The population of this research is about Senior High School's Physics Exam in Agam Regency for the 2019/2020 academic year. The research data was taken using an analytical instrument of question presentation and data collection techniques through documentation. Based on the research that has been done, it is found that the percentage of HOTS indicators for each question is 39.15% for class X semester 1, 38.5% for class X semester 2, 36.3% for class XI semester 1, 18.25% for class XI semester 2 and 24.5% for class XII semester 1 and for HOTS indicators that are often found in Physics Exam questions are the Problem Solving and Critical Thinking indicators, followed by decision making indicators while the least encountered is the Creative Thinking indicator.

Keywords : *Analysis, Indicator HOTS; Exam Questions.*



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I. INTRODUCTION

Efforts to improve the quality of education in Indonesia continue to be carried out by the Government. One of the agendas that continues to be carried out is curriculum development [1]. One of the potentials of students that need to be improved is intelligence as implied in the law. One of the ways to improve the intelligence of students is by developing students' thinking skills in solving problems. Thinking skills are very important in describing and explaining phenomena. Higher-order thinking skills are an approach in learning where students are taught to think critically, logically, reflectively, metacognitively, and creatively. This is in accordance with the characteristics of the skills of the 21st-century society according to the partnership of 21st century skills which identifies that students in the 21st century must be able to develop the competitive skills needed in the 21st-century that are focused on developing HOTS [2].

The 2013 curriculum which is currently being implemented by the government also requires students to think at a higher level. This is indicated by the presence of several operational verbs that show the students' higher-order thinking skills in the core competencies (KI) of the 2013 curriculum. Implementing HOTS questions in learning is the time to be applied. HOTS-based questions can make students skilled in the ability to solve problems, skilled

in decision making. The ability of Higher Order Thinking Skills (HOTS) is an asset for students in facing a more advanced life in the future.

It is time to implement HOTS questions in learning. HOTS-based questions can make students skilled in the ability to solve problems, skilled in decision making. HOTS ability can help students to argue appropriately and effectively in making rational decisions or solutions. HOTS abilities can also make students more active, work together, and think broadly. The ability of *Higher Order Thinking Skills* (HOTS) is an asset for students in facing a more advanced life in the future.

The reality in the field, the questions usually tend to test more aspects of memory to analyze. Even though there are many books that present material by inviting students to learn actively, the presentation of concepts is very systematic, but often ends with evaluation questions that do not train students' higher-order thinking skills [3]. The evaluation questions to train students to be skilled can be done by the teacher by training questions that invite students to think at the level of analysis, evaluation and creation.

The results of the 2011 Trends in Mathematics and Science Studies International (TIMSS) study show that Indonesia ranks 40th out of 42 or ranks 3rd from the bottom, higher than Morocco and Gana in the field of science [4]. Likewise, the Program for International Student Assessment (PISA) in 2015 showed that Indonesia's SAINS ability was in the 9th lowest rank or 71st rank out of 79 PISA participating countries. This shows that Indonesia is still in the lower category in solving problems with the HOTS category as well as illustrating the importance of teachers directing their students to think at a higher level to be able to compete with other countries.

The results of the initial documentation study, researchers made observations about learning models and teaching materials used in schools, researchers found that schools had used student-centered learning models. Besides that, the teaching materials used have also been HOTS oriented even though they are in a low category, this the researchers know based on the research that has been done [5].

The 2018 National Physics Examination score in Agam Regency is still below the average score of the West Sumatra Provincial Physics National Examination, which is 43.94 while the average value of the West Sumatra Province Physics National Examination is 44.02. It is known that the level of understanding of concepts and learning outcomes of physics students is still not optimal. The ability of students in answering HOTS questions is also not maximized.

Based on the description above, it can be seen that there is a difference between ideal conditions and actual conditions in the field where the learning tools and Student Worksheets are already HOTS-oriented, but the students' ability to answer the HOTS-categorized National Examination questions is still low. It has not been identified whether the HOTS indicator is already available in the questions for the Physics Examination given by the teacher at school. Therefore, it is necessary to research to find out whether the questions for Physics Examination at SMAN Se-Agam Regency already have HOTS indicators.

II. METHOD

Based on the background that the researcher has put forward, the purpose of this study is to determine the availability of HOTS indicators on the questions of Physics Examination of high school in Agam Regency with a descriptive research type with a qualitative approach. Descriptive research is research that is used to collect information about the status of an existing symptom, namely the actual situation at the time the research was carried out without making conclusions that apply to the public or generalizations. Descriptive research is the most basic form of research, aimed at describing or describing existing phenomena, both natural phenomena and human engineering [6]. The qualitative approach is research that produces descriptive data in the form of written or spoken words from people and observed behavior [7].

The population is a generalization area consisting of objects or subjects that have certain qualities and characteristics determined by the researcher to be studied and then drawn conclusions [8]. The population of this study is all the questions for the Mid-Semester Examination and the Physics Semester Exam used in high schools in Agam district in the 2018/2019 and 2019/2020 school years. The research sample is part of the number and characteristics of the population [9]. In this study, because the Physics UAS questions for SMAN Se - Agam Regency were made by the Agam Regency Physics MGMP, the sample of this study was the total population, namely the Physics UAS questions for SMAN Se - Agam Regency in the 2019/2020 school year.

Instruments are tools used to approach the research objectives. A research instrument is a tool used to measure the observed natural and social phenomena. The research instruments used were compiled by themselves and their validity will be tested [10]. Based on the purpose of the research conducted, a research instrument is needed to analyze the questions in the form of an analysis sheet in the form of a statement regarding the HOTS indicators on Physics questions for high schools in Agam district.

The research instrument used was compiled and tested for validity. To develop a good instrument, it is necessary to take several steps [11], namely:

1. Planning, stages of goal formulation, determining variables, and their categories. A literature review was conducted regarding the variables to be included in the instrument, the purpose of making it, and instructions for filling it out.
2. Writing the instrument grid. The instrument grid is designed first before writing down the instrument items. The instrument grid is made in the form of a table containing indicators, sub-indicators, and instrument item numbers, then the instrument is made according to the previously designed grid.
3. Writing the items of the instrument. In this stage, the writing of the instrument items is based on the grid that has been designed.
4. The trial, in the form of validity test. The instrument trial was conducted to determine whether the instrument that the researcher used was valid or not to be used in the study, before the validity test was carried out, the examiner first conducted instrument guidance to the supervisor.

For the overall validity, the researcher used the Kappa Cohen formula [12]. At the end of the assessment, the moment kappa (k) value was obtained. The kappa moment decision categories obtained are in Table 1.

$$\text{Moment Kappa } (k) = \frac{P_o - P_e}{1 - P_e} \quad (1)$$

With :

k = kappa moment (product validity)

P_o = realized proportion (the number of values given by the validator divided by the maximum number of values)

P_e = the proportion that is not realized (the maximum number of values minus the total value given by the validator divided by the maximum number of values).

Table 1. Decision Category Based on Kappa Moment (k)

Interval	Category
0,81 – 1,00	Very valid
0,61 – 0,80	Valid
0,41 – 0,60	Quite valid
0,21 – 0,40	Not valid
0,01 – 0,20	Invalid

(Source : Ref[12])

The validation results obtained from two expert validators are in the valid category. These results can be seen in Table 2.

Table 2. Results of Instrument Validations by Two Validators

No	Validator's Name	Score	Category
1	1 st Expert	0,77	Valid
2	2 nd Expert	0,75	Valid

After being validated by two expert lecturers, then revisions are made according to the input given by the validator. Next is the stage of data collection. Data collection techniques are methods used to obtain research data or information. Data collection techniques in this study were through documentation studies and interviews. Information is obtained from various written sources or documents[13]. Interviews were conducted by making interview guide sheets. The interview guide sheet contains questions regarding the learning carried out by teachers in schools related to HOTS. This documentation study is carried out by collecting documents or data needed in research problems which are then studied in depth. The data obtained through the documentation method is the HOTS indicator data on Physics questions in several schools related to the HOTS component.

The procedure in the research is divided into three stages, namely the preparation, implementation, and completion stages.

1. Preparation Stage

Several things must be done at this stage, including; conducting preliminary observations to find out information about the questions of Physics Examination in the Agam Regency, determining the subject and object of research in the form of questions from schools to be analyzed and preparing research instruments.

2. Implementation Stage

At the implementation stage, all the questions for Physics Examination are collected which will later be analyzed using instruments that have been validated as needed.

3. Completion Stage

After analyzing each question, the next stage of completion is carried out. There are several things that must be done at this stage, including; processing research data, presenting the number of occurrences of instrument items in each analyzed question, interpreting research data by determining HOTS indicator criteria, drawing conclusions from research, and reporting research results.

After the three stages of the research procedure were carried out, the next step was data processing. The data analysis technique used in this study is a content analysis technique, namely analyzing the content of the written data. Content analysis is research conducted systematically on records or documents as data sources. The characteristics of this research are (a) research is conducted on documented information in the form of recordings, pictures, and so on, (b) the research subjects are goods, books, magazines, and so on, (c) documents are used as basic data.

The data processing technique used in this study is related to the HOTS indicator by:

1. Summing up the appearance of the HOTS indicator instrument items in each of the analyzed questions
2. Calculate the percentage of the availability of the HOTS indicator in the Question

$$\frac{\sum \text{keterampilan HOTS yang muncul}}{\sum \text{keterampilan HOTS}} \times 100\% \quad (2)$$
3. Determining the criteria for the availability of HOTS on physics questions can be seen in Table 3.

Table 3. Criteria For the availability of HOTS indicators on Physics question

Criteria	Category
81% –	Very available
61%– 80%	Can be available
41% –60%	Sufficiently available
21% –40%	Less available
0% – 20%	Not available

(Source: Ref [14])

Concluding, conclusions from the data that has been obtained.

III. RESULTS AND DISCUSSION

A. Research Result

Based on the research objectives, data was obtained about the availability of the HOTS indicator on the Physics UAS questions of SMANs in Agam Regency. The first analysis was conducted to obtain the percentage of the availability of HOTS questions in each question text based on Anderson & Krathwohl Revised Bloom's Taxonomy. The percentage of availability of HOTS question based on Anderson & Krathwohl Revised Bloom's Taxonomy can be seen in Table 4.

Table 4. HOTS Indicator Availability Data Presentation for UAS questions in class X, XI and XII semesters 1 and 2 in the 2019/2020 school year

Class	Semester	LOTS (%)	MOTS (%)	HOTS (%)
X	1	15%	45%	40%
	2	4%	68%	28%
XI	1	13,3%	73,4%	13,3%
	2	20%	68%	12%
XII	1	0%	66,6%	33,4%

The percentage of availability of HOTS questions varies for each question text. Based on the composition of the questions according to the Minister of Education and Culture on the 2019 UN questions based on their cognitive level, namely 10% - 15% for reasoning, 50% - 60% for applications, and 25% - 30% for knowledge and understanding, the percentage of HOTS questions on Physics UAS questions in Agam Regency already meet the standard of availability of HOTS questions that should be with a percentage ranging from 12% - 40%.

The second analysis was conducted to determine the percentage of the availability of the HOTS indicator on each HOTS-based item. The questions at levels C4, C5 and C6 found in the text of the Physics UAS questions for class X, XI and XII in the 2019/2020 school year were then re-analyzed to determine the availability of the

HOTS indicator on each question. The HOTS indicators used in this study are Problem Solving, Decision Making Skills, Critical Thinking, and Creative Thinking. The availability of four HOTS indicators on the Physics UAS questions for SMANs in Agam Regency is described at Table 5.

Table 5. HOTS Indicator Availability Data Presentation for UAS questions in class X, XI and XII semesters 1 and 2 in the 2019/2020 school year

Class	Semester	Problem Solving	Decision Making Skills	Critical Thinking	Creative Thinking	Average	Category
X	1	66.7%	42.3%	33,3%	14.3%	39.15%	Less Available
	2	66.7%	14.3%	44,4%	28.6%	38.5%	Less Available
XI	1	50%	28.6%	66,7%	0%	36.3%	Less Available
	2	33.3%	14.3%	11,1%	14.3 %	18.25%	Less Available
XII	1	58.3%	28.6%	11,1%	0%	24.5%	Less Available

Presents data related to the 4 HOTS components in each question. Based on the table, the percentage of HOTS component availability varies in each question. From the table, it can be seen that the HOTS indicator on the physics exam at SMAN in Agam Regency is less available. The results of the analysis of the HOTS Indicator based on the 4 HOTS Indicators can be seen in Figure 1.

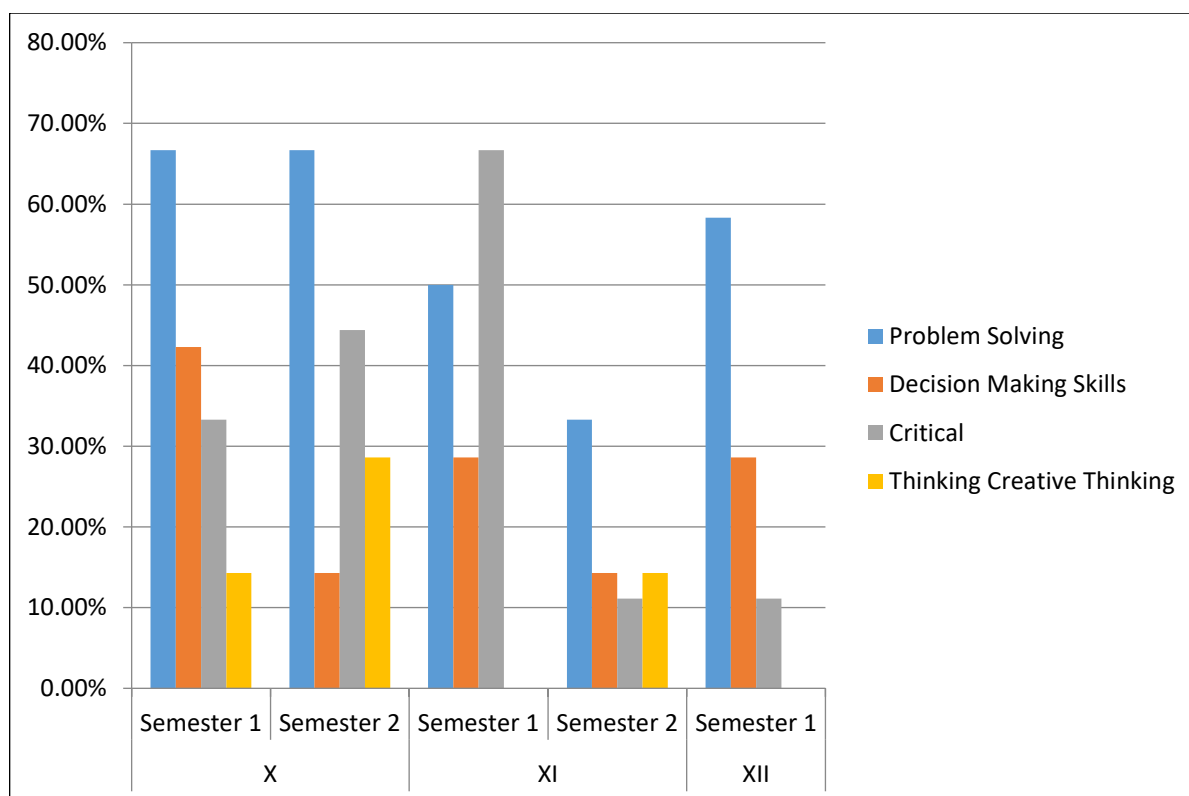


Fig 1. Percentage of Availability of HOTS Indicators on Physics questions at SMAN Agam based on 4 HOTS indicators

Based on the picture above, it can be seen that the availability of HOTS indicators for UAS questions at SMAN Agam for HOTS indicators for Problem Solving in class X semester 1 with a percentage of 66.70%, for class X semester 2 with a percentage of 66.70%, for class XI semester 1 with a percentage of 50%, for class XI semester 2 with a percentage of 33.30% and for class XII semester 1 with a percentage of 58.30%. For indicators of Decision Making Skills in class X semester 1 with a percentage of 42.30%, for class X semester 2 with a percentage of 14.30%, for class XI semester 1 with a percentage of 28.60%, for class XI semester 2 with a percentage of 14, 30% and for class XII semester 1 with a percentage of 28.60%. For indicators of Critical Thinking in class X semester 1 with a percentage of 33.30%, for class X semester 2 with a percentage of 44.40%, for class

XI semester 1 with a percentage of 66.70%, for class XI semester 2 with a percentage of 11.10 % and for class XII semester 1 with a percentage of 11.10%. For indicators of Creative Thinking in class X semester 1 with a percentage of 14.30%, for class X semester 2 with a percentage of 28.60%, for class XI semester 1 with a percentage of 0%, for class XI semester 2 with a percentage of 14.30% and for class XII semester 1 with a percentage of 0%. Based on the data above, it can be concluded that the dominant HOTS indicator appears, namely the Problem Solving indicator and the least appears, namely the Creative Thinking indicator[15].

B. Discussion

The analysis of indicators HOTS on physics questions related to the availability of HOTS indicators aims to determine the availability of HOTS component indicators[16]. The HOTS indicator contains 4 HOTS indicators such as: problem solving, decision-making skills, critical thinking and creative thinking in physics exam questions used by SMANs throughout Agam Regency. It is very important, the evaluation in the form of questions that function to measure the progress to be achieved by students, HOTS questions are arranged based on the level of domains C4, C5, and C6 which are formulated in indicators questions that students can train in solving problems with higher order thinking[17]. According to Anderson & Krathwol's opinion, the domain of cognitive processes included in high-level abilities is analysis at the C4 level, evaluation at the C5 level and creating at the C6 level[18].

In the physics exam at SMAN Agam Regency, where the UAS questions are made by the Agam MGMP, it means that all schools use the same questions. After analyzing the availability of HOTS questions on the Physics UAS questions of SMANs in Agam Regency based on the Proportion of preparation of the 2019 National Examination questions by the Minister of Education and Culture, the proportion of HOTS questions on Physics UAS questions for SMANs in Agam Regency is sufficient and even exceeds the proportion of HOTS questions that should be. Subsequent analysis was carried out to determine the availability of HOTS indicators based on 4 HOTS indicators, the percentage data obtained. The most dominant indicator appears is the Problem Solving indicator and the indicator that appears minimal is the Creative Thinking Indicator, whereas creative thinking skills are very important for students to have in solving a problem because creative thinking students can solve a problem from various solutions (Armitage, Phil, & Ryberg, 2018). This is in line with the opinion (Nehe et al. 2017) that by thinking creatively, students can use reason to create ideas, create new, original, ideas that will later serve to find answers to a combined problem so that it shows the existence of a creative thinking component. We recommend that all components can help students to train order thinking higher. If students' high-level thinking is not trained, it will greatly affect the results of the evaluation carried out by students, especially on the UN, because the UN questions will be the same in every school in Agam Regency as well as the UAS questions. Because the solution to the problem is so that the teacher can apply HOTS-based questions which later students will get used to working on HOTS questions. This is proven through interviews during observations where teachers have implemented the 2013 curriculum but teachers have not implemented HOTS-based questions. Because from the results of the analysis it is known that the use of the HOTS Indicator is still not fulfilled

The HOTS questions found on average are at the C4 cognitive level (analyzing). Overall, the lowest HOTS skill presentation was on creative thinking skills. This is related to the results of interviews that researchers interviewed with teachers where schools had implemented the 2013 curriculum but schools had not implemented questions based on the HOTS indicator, therefore the questions did not require students to think creatively in solving problems on the questions. Was supposed to have implemented the 2013 curriculum teachers must accompany about HOTS-questions based curriculum that will be in line with 2013, which requires students to think critically.

IV. CONCLUSION

Based on the results of the analysis of the HOTS indicator analysis on the physics UAS questions for SMAN class X, XI and XII in the 2019/2020 academic year, it can be concluded that every UAS question is included in the less available category. For the use of indicators on the Physics UAS questions of SMAN Se - Agam Regency, the indicator that is often used is the indicator of problem solving and the one that is rarely used is the indicator of creative thinking.

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